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Effect of the Prevailing Speed Law Type on the Traffic Fatality Rate in the U. S.¹

By CLIFFORD O. SWANSON

INTRODUCTION

With total registrations of all types of vehicles, including passenger cars, buses and trucks, of over 65,000,000 in 1956, the importance of the maximum use of traffic control devices to reduce the vehicle accident death rate becomes even greater. Estimates are that the number of motor-vehicles in the U. S. is expected to reach 81,000,000 by 1965.⁵

Among the more important methods of speed control today is that provided by legislation in the form of statutes defining minimum and maximum limits in various areas. However, the success of the enforcement of any traffic law is dependent on its acceptance by the public. Obedience of the law must receive the support of drivers and pedestrians alike through voluntary cooperation.

Those highway users guilty of unlawful driving behavior for whatever reasons alleged, must be controlled by other more stringent means. Ordinarily the number of individuals who do not conform to rules of the road will be few. This means the enforcement agencies must have the power to apprehend and punish those violators to produce the necessary deterrent effect and to decrease the hazards of driving.

Speed in itself primarily contributes to accidents when it is excessive or too fast for conditions. There are times when a speed of 10 miles per hour may be unsafe. When speed is a contributing factor, the higher the speed the greater the severity of the accident. A summary of 1954 accidents shows that in one out of every three fatal accidents a speed violation was involved, i.e. exceeding a speed limit or driving too fast for prevailing conditions.⁴

The purpose of this study is to ascertain what relationship, if any, exists between the several types of speed laws used in the United States and the traffic death rate per 100 million vehicle miles of travel during the 20-year period, 1935 to 1954. Any association found between speed laws and traffic death rates during this time should provide evidence from which a reasonably substantial in-

¹ This study was carried out at the Driving Research Laboratory through assistance from the Allstate Grant for Driving Research. It was made under the joint direction of Dr. A. R. Lauer and Dr. James E. Wert.

ference may be drawn that will help to decide which statute type, or variation, that by its operation has proved most effective in reducing traffic fatalities. The null hypothesis that no relation between speed law type and traffic fatalities exists was tested.

METHOD OF PROCEDURE

The study, here reported, of the relationship between prevailing state motor-vehicle speed laws and traffic death rates per 100 million vehicle miles covers the 20-year period beginning with 1935 and ending with 1954.

1. Types of Speed Regulations Extant.

Three types of legislated speed control measures are in use in the U. S. today, i.e. (a) absolute, (b) *prima facie*, and (c) basic. Those types having specific numerical limits specified by the statute are the absolute and the *prima facie*. It is usually assumed that the basic law also operates along with (a) and (b).

a. *Prima facie speed limit*. In this type statute the basic rule is supplemented by certain numerical speed limits. According to the phraseology of section 11-801 of the revised 1954 version of the Uniform Vehicle Code² which advocated this type of legislation up until a year ago, is in effect as follows:

"The speed of any vehicle not in excess of the limits specified . . . shall be lawful but any speed in excess of the limits specified . . . shall be *prima facie* evidence that the speed is not reasonable and prudent and that it is unlawful."

The effect of this *prima facie* provision is as follows: If a person proceeds at a speed below the *prima facie* limit, the burden of proof is upon the state if it wishes to challenge the driver's speed as violating the basic rule. However, if a person drives faster than the *prima facie* limit and is arrested, the burden of proof shifts and it is the responsibility of the individual driver to prove, if brought to court, that although he was exceeding the *prima facie* speed limit he was nevertheless driving in accordance with the basic rule. Variations taken into consideration under this statute type were those of speeds of an equal maximum for day and night driving were legislated, as well as unequal day and night limitations.

b. *Absolute or fixed speed limit*. The same basic rule applies under this statute type as it does for the *prima facie* speed limit. It is a more rigid type statute in that it is illegal to exceed the fixed limitations at any time or under any circumstances. A slight tolerance of five mph is very often allowed although this is at the discretion of the enforcement officer. Legislated limits for day or night may be set equally or unequally, similar to the *prima facie* type.

c. *Basic speed limit.* By virtue of its composition no specific speed limits are set since the road user is supposed to travel at a speed no greater than is reasonable and proper with the various conditions as they prevail at the time. The merit of the law is accepted in all states and it usually applies even though other speed laws are designated legal.

2. Type of Accident Record Analysis.

The rate stated in relation to the number of deaths, pedestrian and nonpedestrian, per 100 million vehicle miles travel is the type of accident record analysis chosen to be correlated with the prevailing speed law types as were defined above.

Secular trend¹ was eliminated from each state's yearly traffic death rate and the resulting 20-year period under study. This was accomplished by dividing each state's fatality rate per 100 million miles vehicular travel each year by the equivalent total U. S. rate for the same year. The fatality rates for each year were thus adjusted so that each state's index rate was based on the total U. S. index rate considered as unity.

3. Collection of Data.

Data on the state motor-vehicle laws for this study were obtained by direct, personal correspondence with officials of the various states. In general, these officials were very cooperative and prompt in supplying the information requested.

Statistical data as required on the absolute number of traffic deaths and the traffic death rate were secured from the National Safety Council.³

The factors controlled in the statistical techniques as used in the study during the adjustment of the traffic death rate index were (a)

Table 1

The means of traffic death rate indexes, population densities and per cent of state administered roads surfaced for all states considered by statute types for years 1935 to 1954 inclusive

| Type of statute | Years experience | Rate indexes | Population density per square mile | Per cent state roads surfaced |
|--|------------------|--------------|------------------------------------|-------------------------------|
| a. Absolute with equal day and night limits | 195 | 107.72 | 119.26 | 88.00 |
| b. Absolute with unequal day and night limits | 37 | 114.11 | 45.44 | 95.49 |
| c. Prima facie with equal day and night limits | 360 | 93.68 | 170.43 | 95.45 |
| d. Prima facie with unequal day and night limits | 115 | 95.57 | 53.79 | 94.80 |
| e. Basic for all years and all states | 253 | 111.74 | 54.37 | 95.19 |
| | 960 | 102.30 | 110.66 | 93.70 |

the 1950 population density per square mile, and (b) the per cent of state administered roads surfaced of each state for 1952. Other factors were recognized which could not easily be controlled.

RESULTS

Upon the completion of assembly and analysis of the necessary statute histories the data were organized as outlined in Table 1.

When the two variables of population density and the percent of state administered roads surfaced were controlled an F-value of 28.58 was obtained. An F-value of this magnitude is significant beyond the one percent level thus rejecting the null hypothesis that there is no difference in traffic death rates per 100 million miles vehicular travel among the states using the various statute types when allowances are made for the two variables considered within each geographical area.

Table 2
Mean index rate adjustments by statute types

| Statute type | Unadjusted index | Adjustment applied ^a | Adjusted index | Rank |
|--|------------------|---------------------------------|----------------|------|
| a. Absolute with equal day and night limits | 107.72 | —6.48 | 101.24 | 3 |
| b. Absolute with unequal day and night limits | 114.11 | —2.30 | 111.81 | 5 |
| c. Prima facie with equal day and night limits | 93.68 | +6.00 | 99.68 | 2 |
| d. Prima facie with unequal day and night limits | 95.57 | —2.58 | 92.99 | 1 |
| e. Basic | 111.74 | —2.07 | 109.67 | 4 |

^a Adjustment corrects for the effect of population density and percent of state administered roads surfaced.

When no control was made an F-value of 20.93 was obtained. Such is an indication that the two variables account for an appreciable part of the difference in the two statistical values.

DISCUSSION

When the criterion means of the five subgroups are adjusted for individual differences in population density and percent of state administered roads surfaced, the difference between the various statute type means is of such magnitude that it undoubtedly was not due to sampling. The differences in the traffic death rate indexes is presumably due to the variation in speed statute types and closely associated factors. The results are shown in Table 2.

It will be noted that statute types a, b and e did not alter their original positions of ranking as to the unadjusted rate compared to the adjusted rate. The basic speed law seems to be low on the list of effectiveness.

SUMMARY

A study was made to test the hypothesis that speed law types prevailing have no effect on traffic death rate per 100 million vehicle miles of travel. No attempt has been made to determine what the exact speed limitation in miles per hour should be. Attenuation was made for population density and the per cent of state administered roads surfaced. From the results it would seem that states showing an increase in death rates and now having other types, might well consider the prima facie speed law type as defined in the revised 1954 version of the Uniform Vehicle Code. Possible daytime alterations in the maximum prima facie limitations on speed might be made.

Within the limitations stated, including the data available, the method used and other restrictions, the following tentative conclusions may be stated that:

1. The hypothesis was rejected.
2. There is some association between the type of speed law prevailing and fatality rate index as was calculated.
3. The states having the lowest fatality rate index tend to use the prima facie type.
4. When attenuation is made for the amount of state administered roads surfaced and the population density per square mile, the results seem to show an advantage for the prima facie type with unequal day and night speed limits.

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